

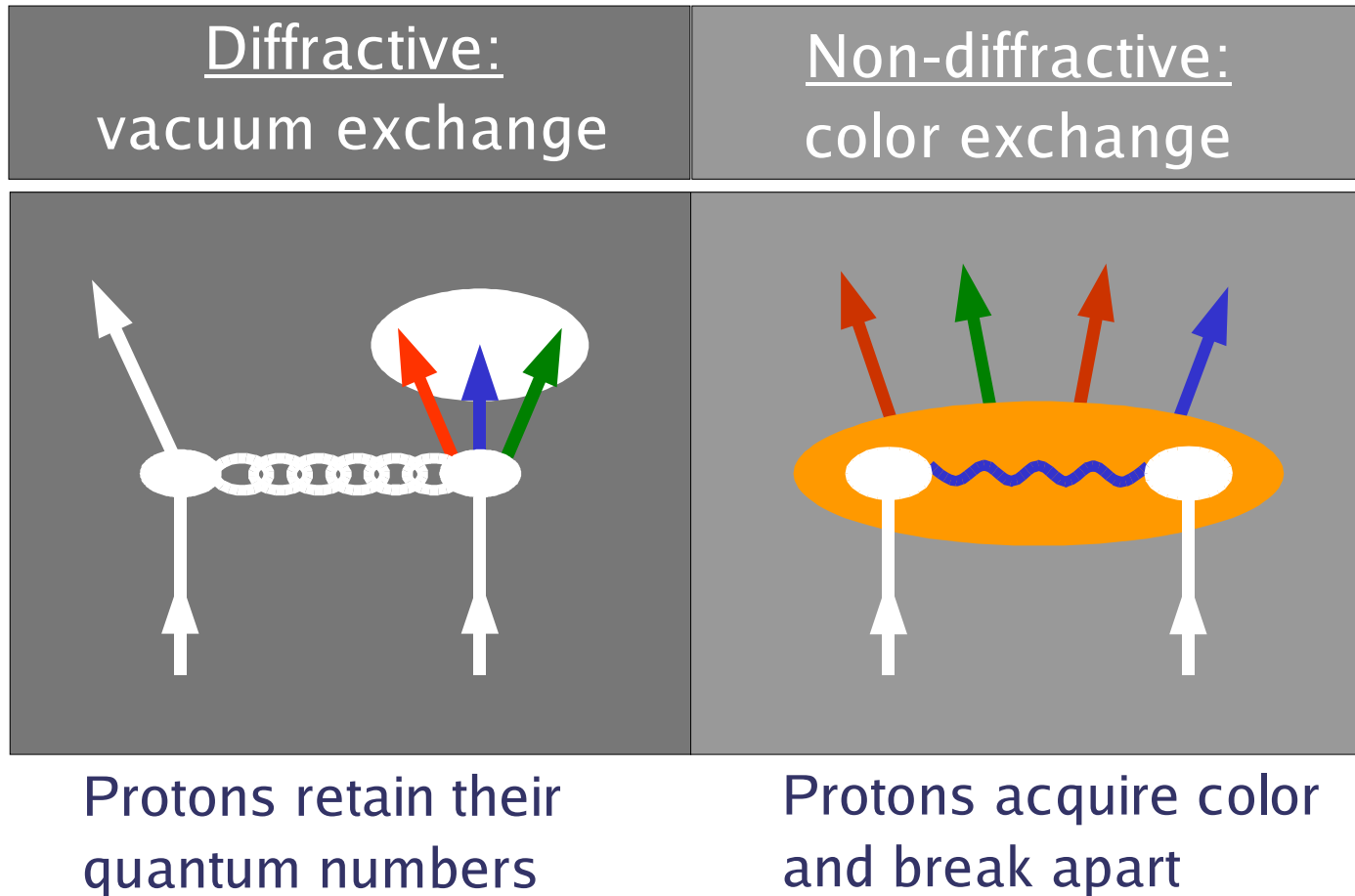


New Diffraction Results from the Tevatron

**Koji Terashi
The Rockefeller University**

on behalf of the CDF and DZero Collaborations

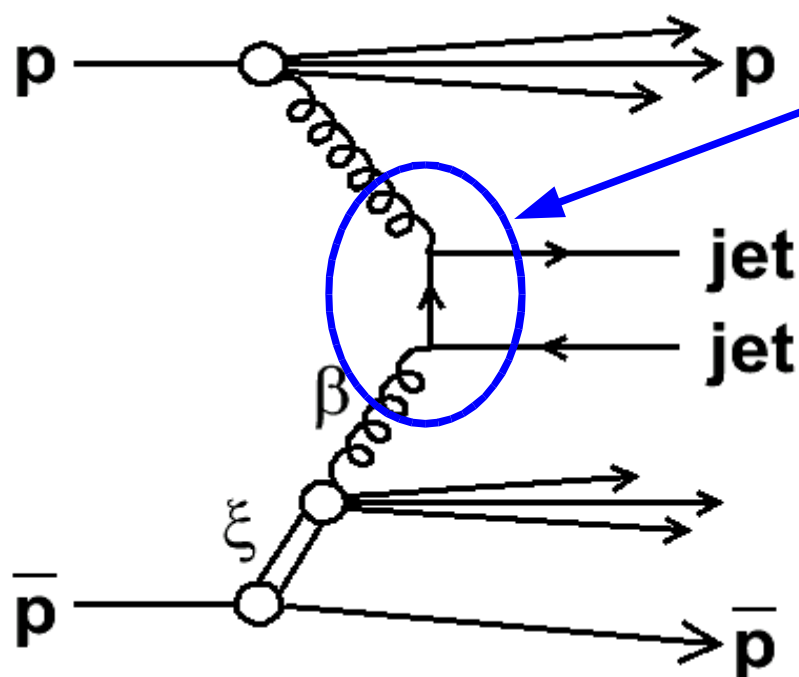
\bar{p} - p Interactions



GOAL :

understand the nature of the colorless exchange

Diffractive Structure Function



Use high p_T (e.g, jets) as a probe
→ *Hard Diffraction*

Diffractive Di-Jets :

$$\sigma(\bar{p}p \rightarrow \bar{p}X) \approx F_{jj} \otimes F_{jj}^D \otimes \hat{\sigma}(ab \rightarrow jj)$$

$$F_{jj}^D = F_{jj}^D(\xi, t, x, Q^2)$$

Diffractive Structure Function

$$\begin{aligned}\beta &= P_{parton} / P_{Pomeron} \\ \xi &= P_{Pomeron} / P_{proton}\end{aligned}$$

Experimental Determination of F_{ij}^D

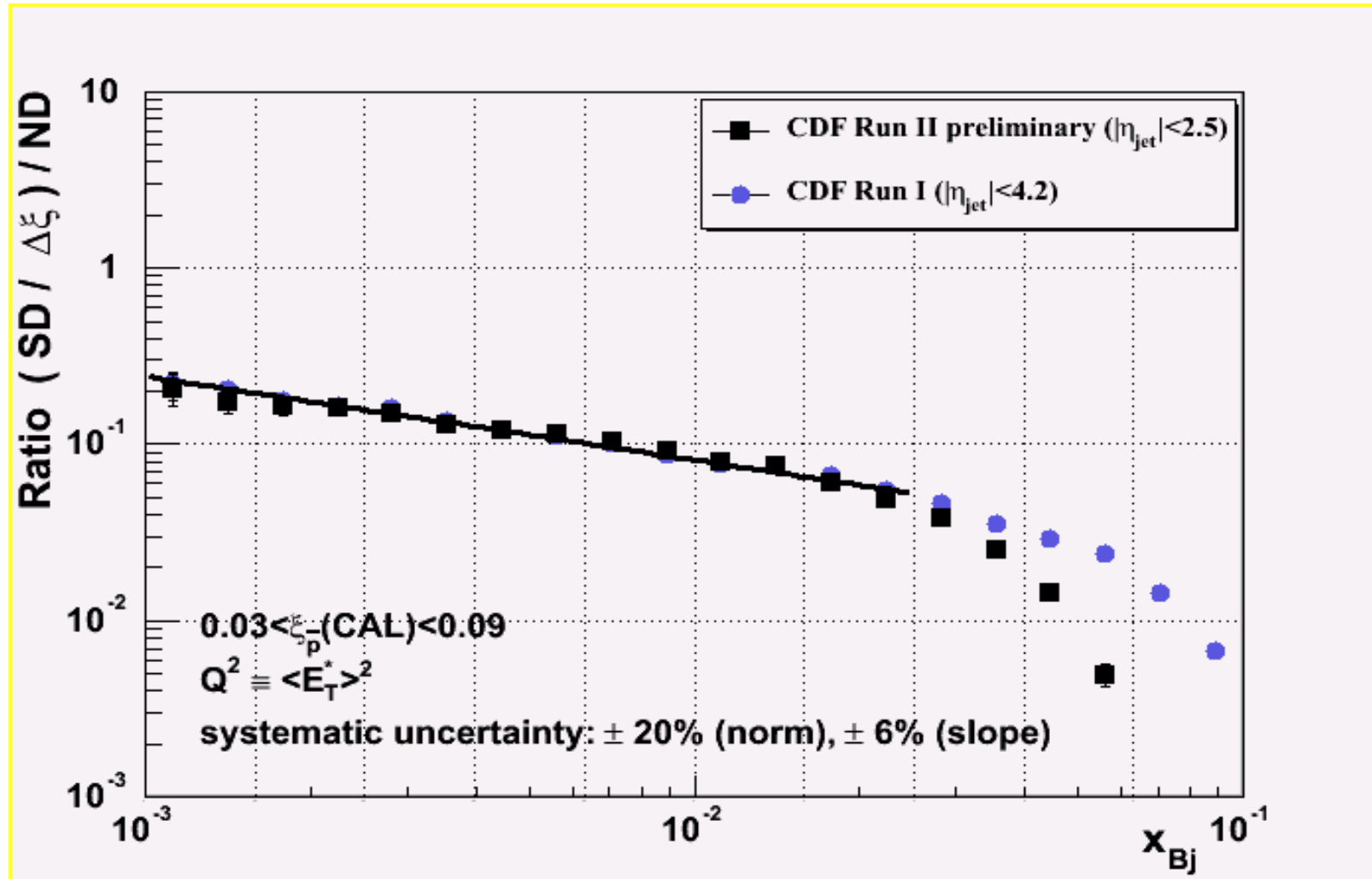
$$R(x) \text{ of } \frac{\sigma_{jj}(SD)}{\sigma_{jj}(ND)} = \frac{F_{jj}^D(x, Q^2)}{F_{jj}(x, Q^2)} \text{ (LO QCD)}$$

↑
Data

Known Proton PDF



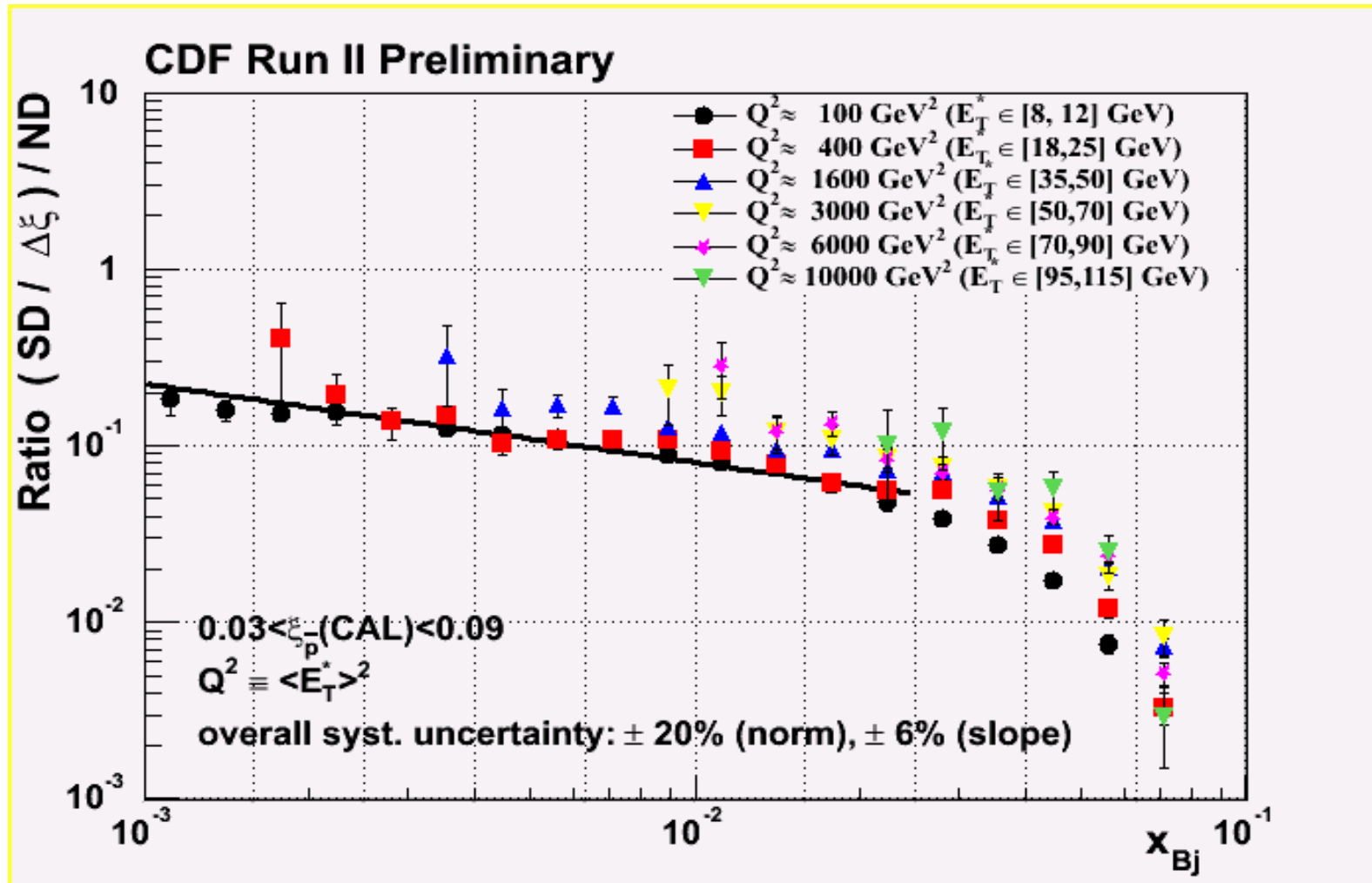
Ratio SD/ND Dijets vs $x_{Bjorken}$



- agreement with Run I result
- no ξ dependence in $0.03 < \xi < 0.09$ → confirms Run I results



Q^2 Dependence of SD/ND Ratio

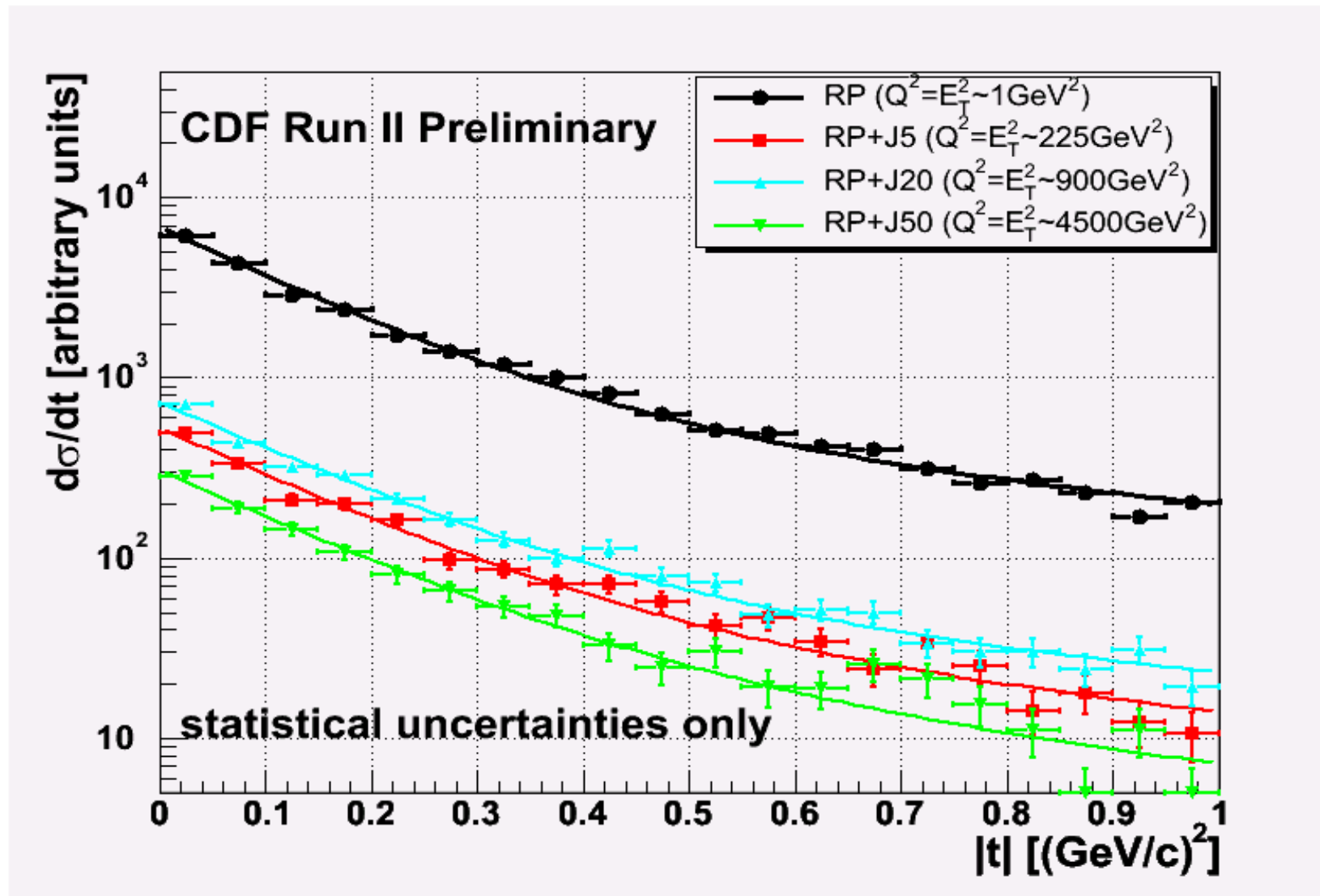


No appreciable Q^2 dependence
 in region $100 < Q^2 < 10000 \text{ GeV}^2$

➔ Pomeron evolves
 similarly to proton



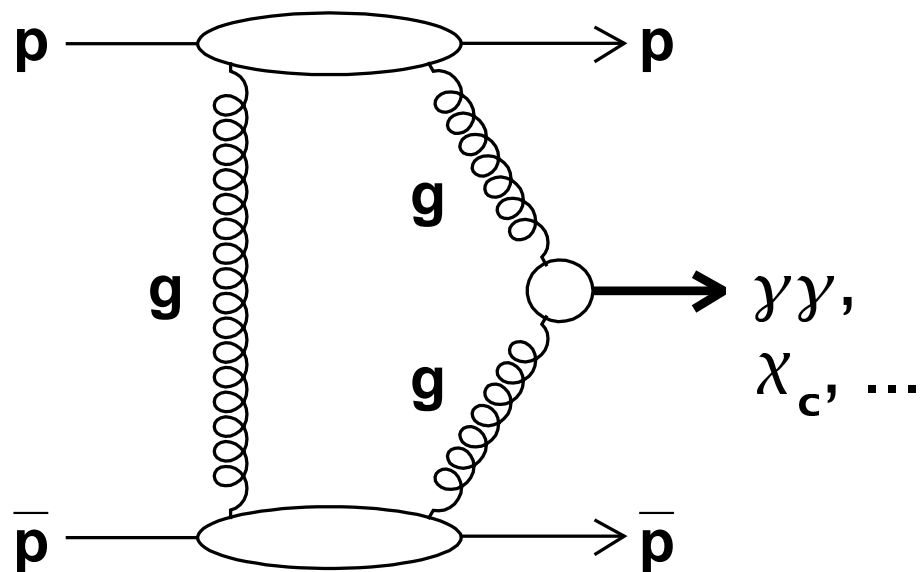
Q^2 Dependence of t in SD Dijets



Slope at $t = 0$ is independent of Q^2

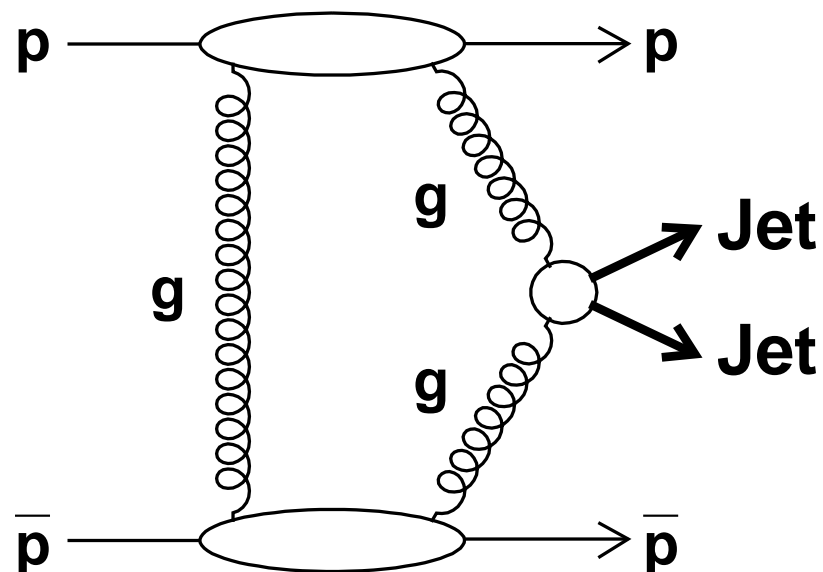
Exclusive Production

Exclusive $\gamma\gamma, \chi_c$



$gg \rightarrow \gamma\gamma, gg \rightarrow \chi_c, \dots$
clean signatures

Exclusive Dijet

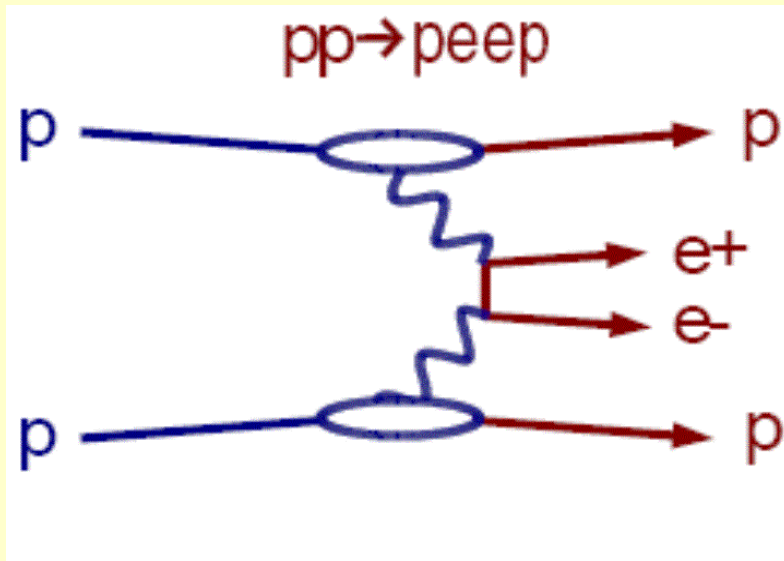


$gg \rightarrow gg, q\bar{q}g, \dots$
 $gg \rightarrow q\bar{q} J_z=0$ suppressed

Measure exclusive $\gamma\gamma$, dijet cross sections to calibrate predictions for exclusive Higgs production at the LHC



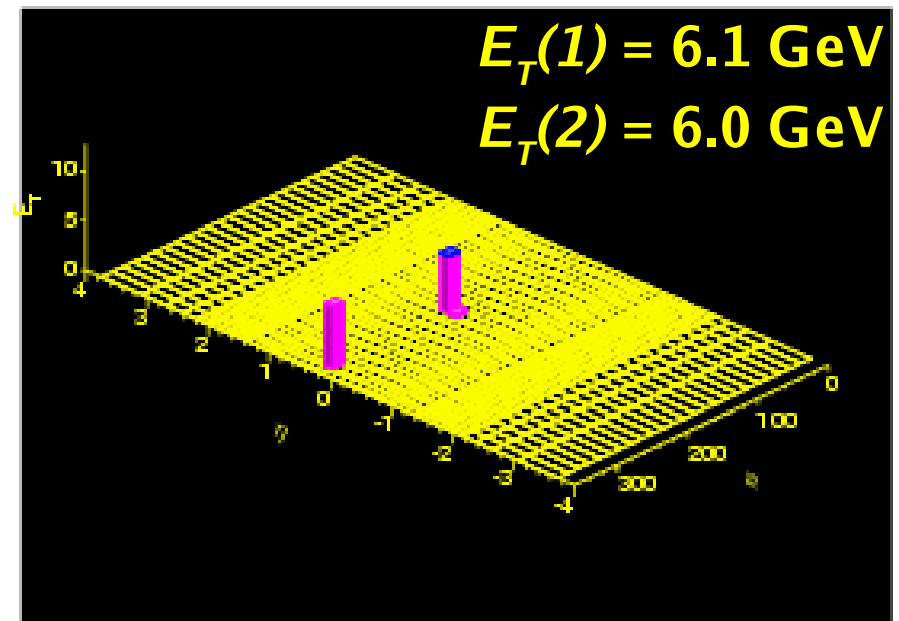
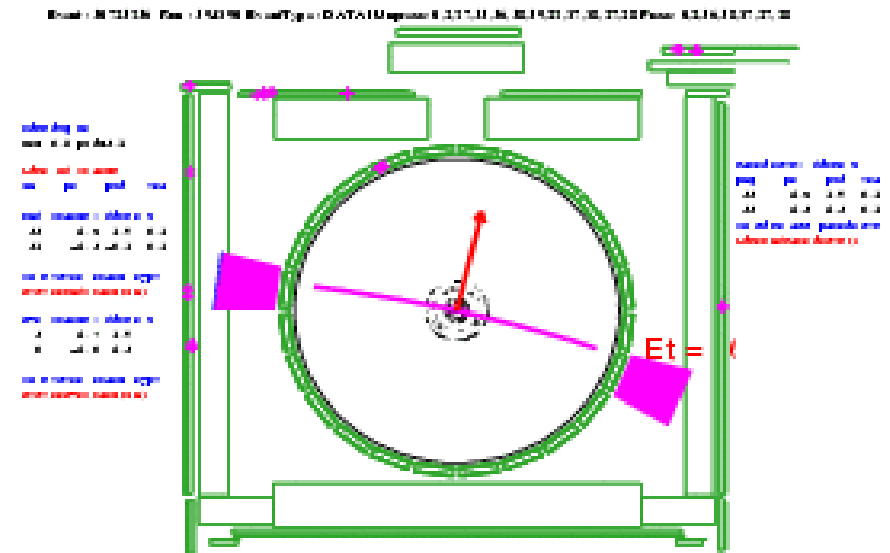
Exclusive ee Candidates



Good control sample
for $\bar{p}p \rightarrow \bar{p}\gamma\gamma p$ search

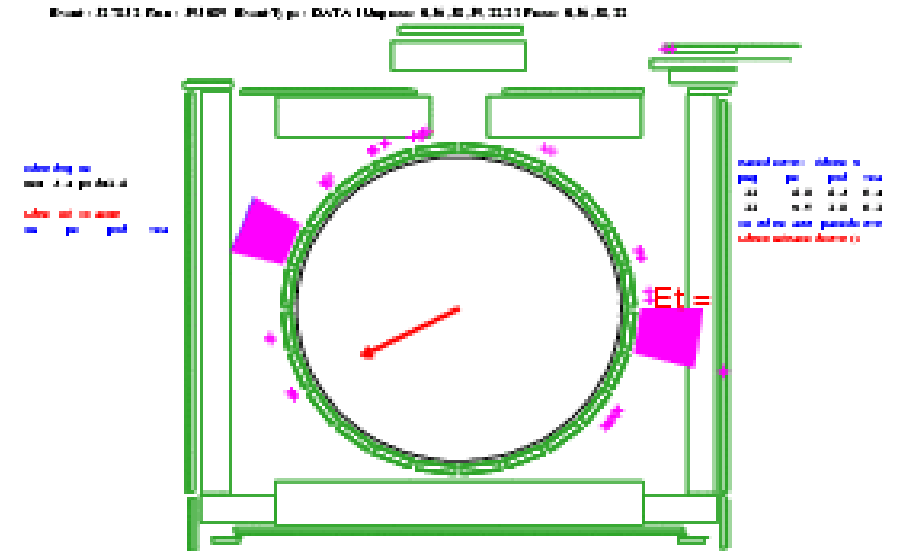
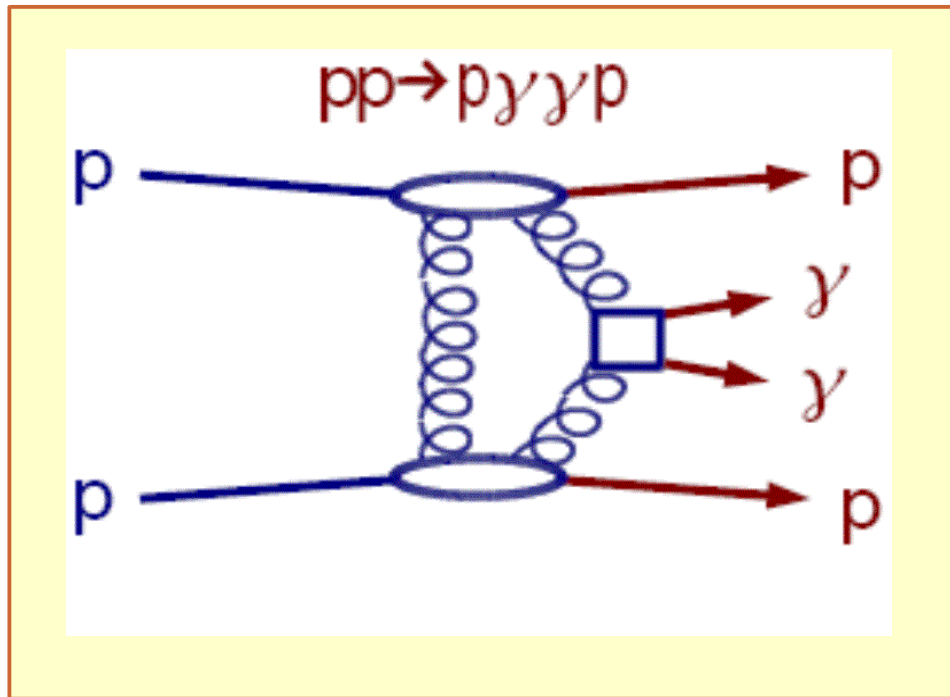
10 candidate events observed

9 ± 3 events predicted by
LPAIR Monte Carlo



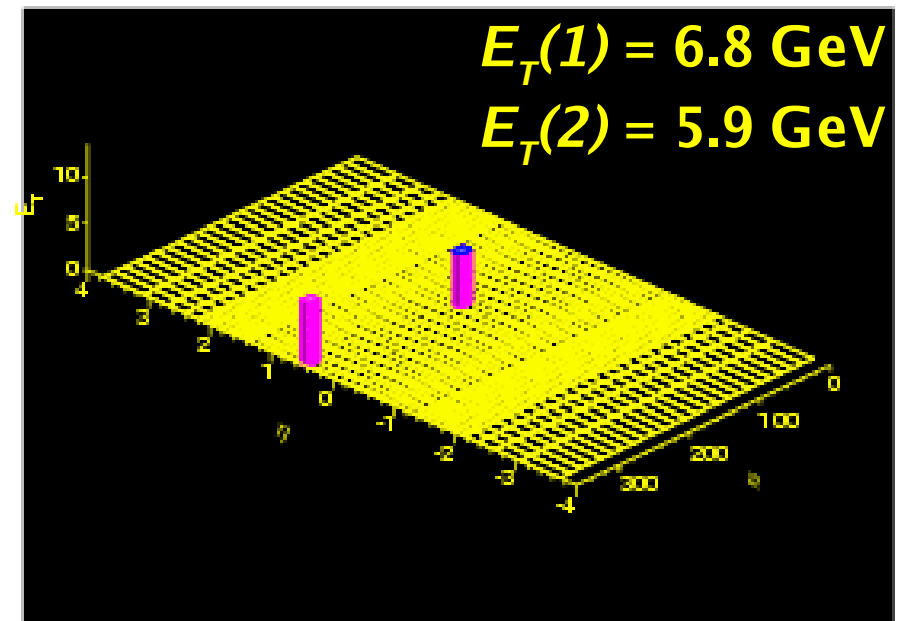


Exclusive $\gamma\gamma$ Candidates



3 candidate events observed

1^{+3}_{-1} events predicted by
ExHuME Monte Carlo
(based on Khoze, Martin, Ryskin)



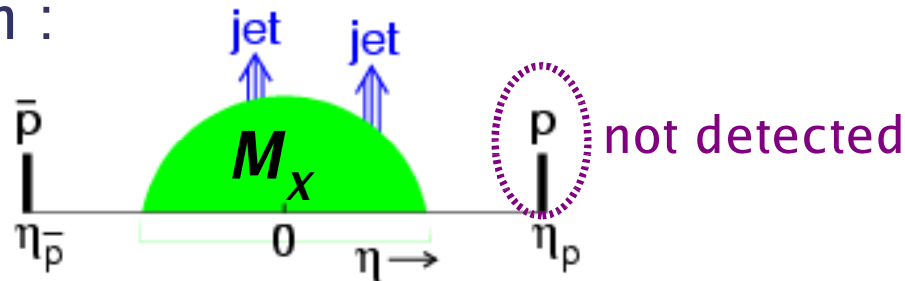


Search for Exclusive Dijets

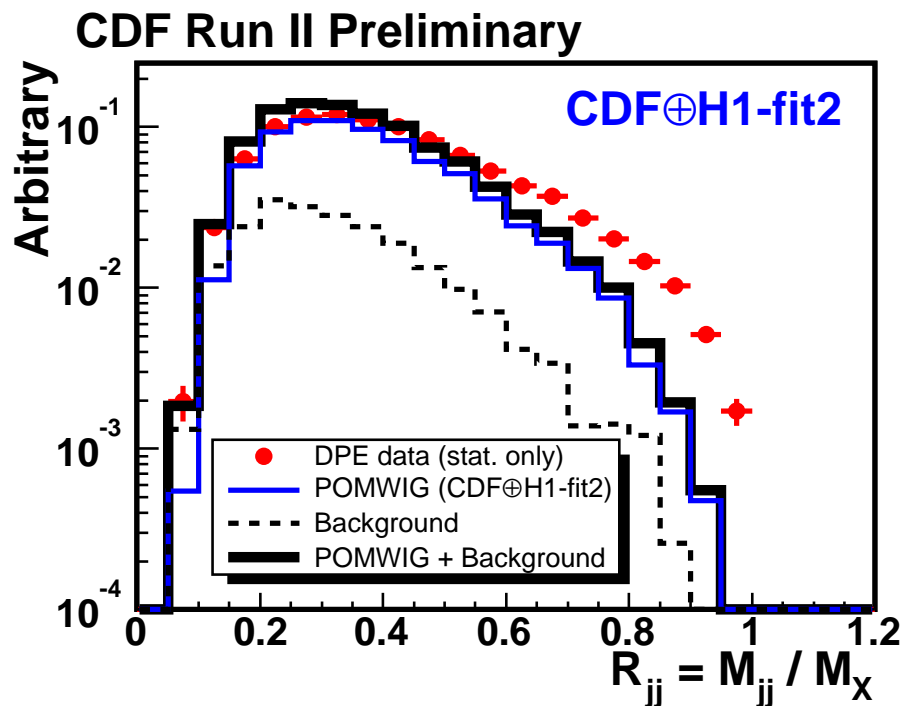
Strategy

- Select inclusive DPE dijets : $\bar{p} + p \rightarrow \bar{p} + X (\geq 2\text{jets}, \dots) + \text{gap}$
- Reconstruct dijet mass fraction :

$$R_{jj} = \frac{M_{jj}}{M_X}$$



- Look for excess in data over inclusive DPE dijet MC (POMWIG)



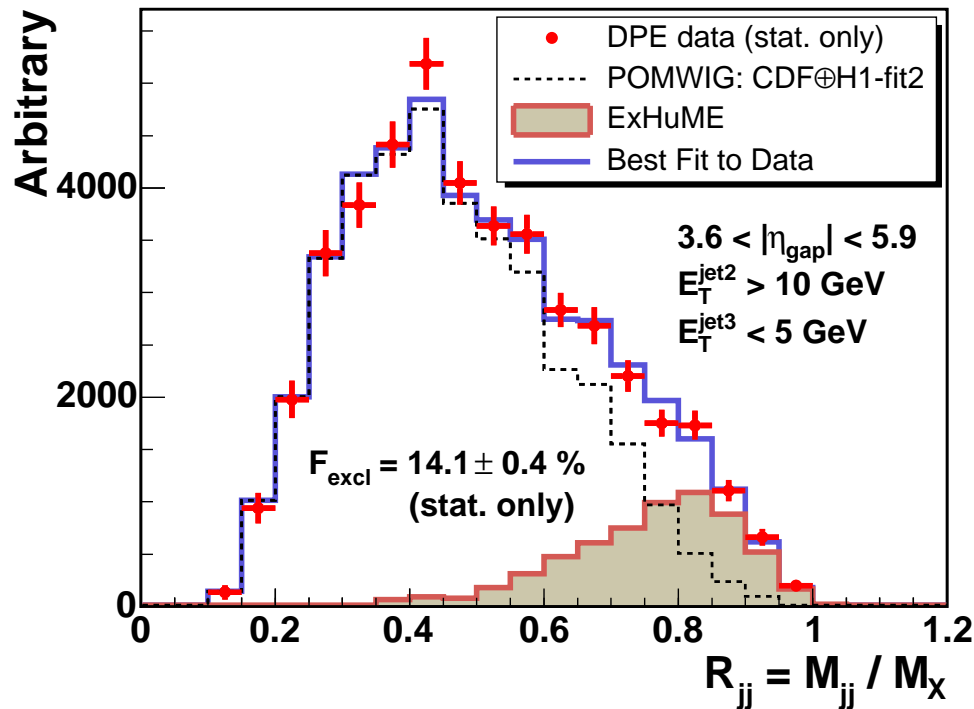
Excess of events in
data observed at high R_{jj}

Are they exclusive signal?



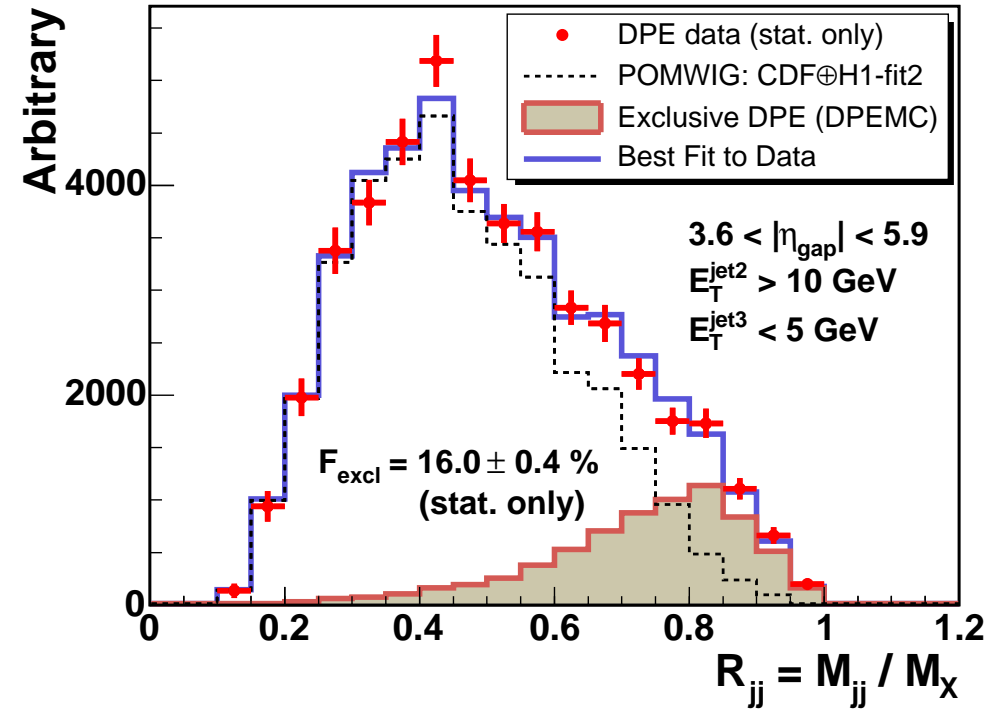
Inclusive+Exclusive Dijet Monte Carlo vs Data in R_{jj}

CDF Run II Preliminary



ExHuME (KMR) : $gg \rightarrow gg$

CDF Run II Preliminary



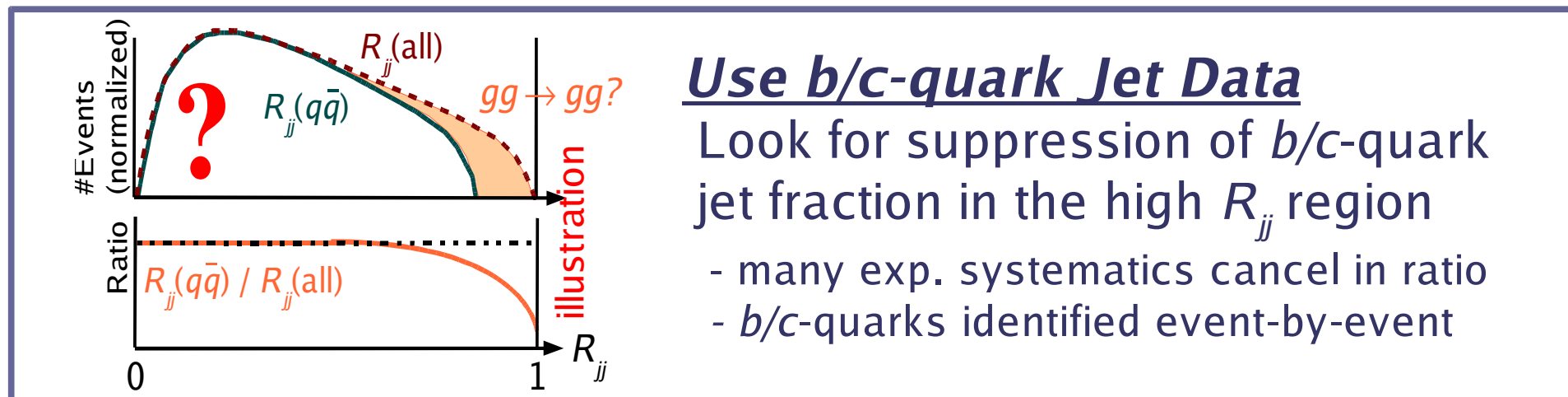
Exclusive DPE (in DPEMC) :
 $IP\ IP \rightarrow 2 \text{ jets}$

The excess in the data is well described by
the two exclusive dijet production models

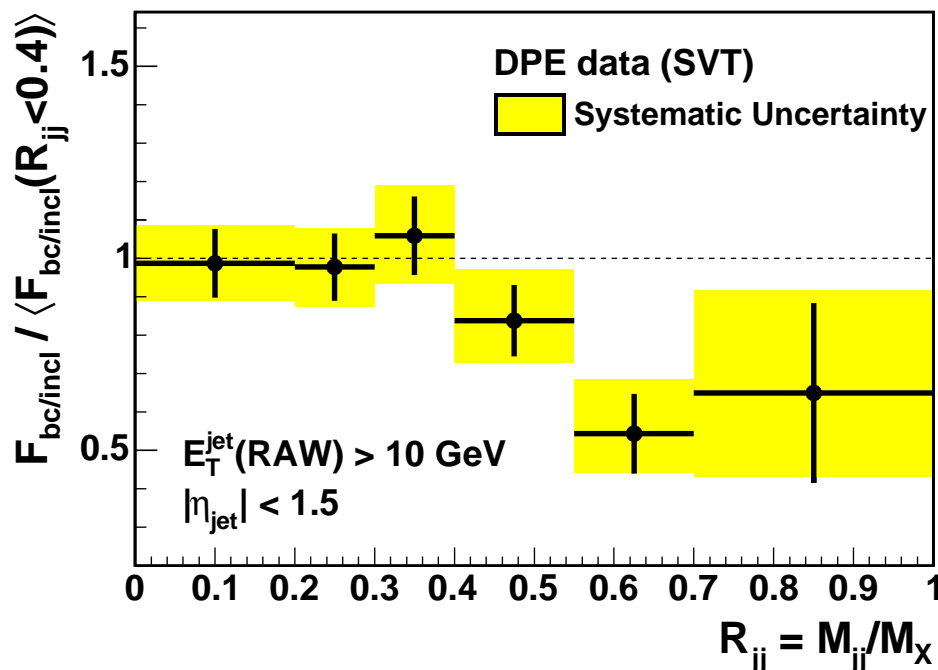


Heavy Flavor Jet Fraction vs R_{jj}

Exclusive $gg \rightarrow q\bar{q}$ $J_z=0$ suppression is expected



CDF Run II Preliminary



Ratio of b/c -jets to all jets
 (normalized to the mean in $R_{jj} < 0.4$)

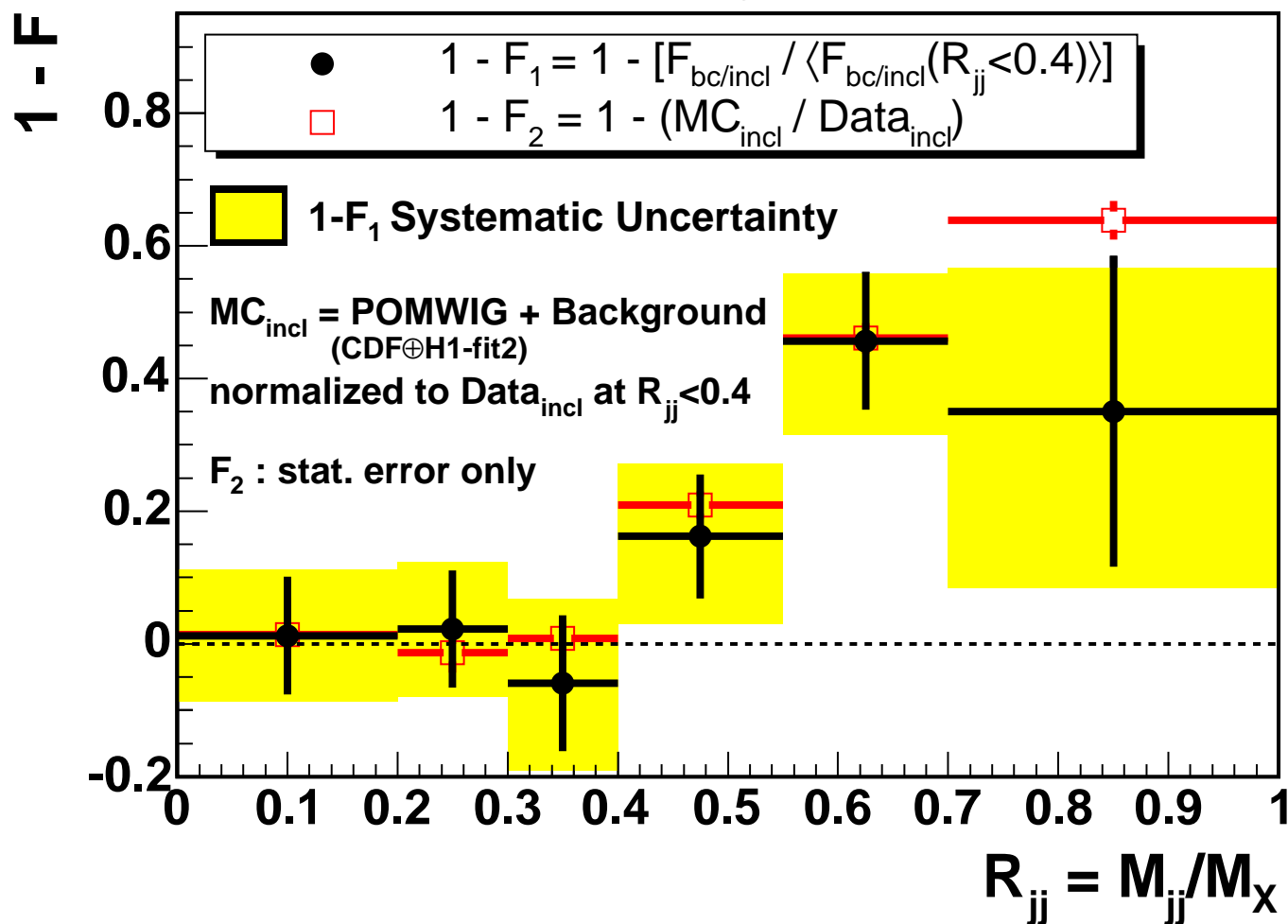


**Decreasing trend
 observed at high R_{jj}**



Comparing Inclusive Data-MC Results and HF-Jet Results

CDF Run II Preliminary



The two results are consistent to each other

Summary

Diffractive Structure Function F^D :

- Re-established Run I results using single diffractive dijets
- Q^2 dependence of $F_{jj}^D \rightarrow$ **Pomeron evolves like proton?**
- Slope at $t = 0$ is independent of Q^2

Exclusive Production :

- Observed 10 (3) events which appear to be consistent with $\bar{p}p \rightarrow \bar{p}eep$ ($\bar{p}p \rightarrow \bar{p}\gamma\gamma p$)
- Observed excess events in data at high R_{jj} , being consistent with the presence of exclusive dijets
- Heavy flavor jet yield relative to inclusive jets appears to be decreased at high $R_{jj} \rightarrow$ manifestation of $J_z = 0$ suppression?
- Exclusive $\gamma\gamma$, dijet cross sections measured soon

Important inputs to
exclusive Higgs at LHC: $pp \rightarrow pHp$



Run II Detectors

